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Janne Väätäjä, janne.vaataja@ulapland.fi

University of Lapland, Finland

 <https://orcid.org/0000-0001-8700-7069>

Satu-Maarit Korte, satu-maarit.korte@ulapland.fi

University of Lapland, Finland

 <https://orcid.org/0000-0001-9768-3431>

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Exploring the conceptions of meaningful digital pedagogy in the context of teacher education practicums

Janne Väättäjä, janne.vaataja@ulapland.fi

University of Lapland, Finland

Satu-Maarit Korte, satu-maarit.korte@ulapland.fi

University of Lapland, Finland

Abstract

Technology integration in teacher training is paramount to adequately prepare student teachers for their future working lives. However, the integration of technology for pedagogical purposes in teacher training is sometimes problematic. The purpose of this study is to identify variations in the features related to meaningful digital pedagogy. This study is aimed at developing practices and pedagogy regarding technology use during teacher education practicums. Another objective of the study is to support the collaborative planning of digital technology inclusion in teaching by student teachers, their supervising in-service teachers and university teacher educators. Data were collected through interviews and analysed with a phenomenographic methodology. The findings indicate that teacher education practicums are commonly perceived as a context for reciprocal learning, wherein participants engage in mutual learning situations. Simultaneously, meaningful digital pedagogy is considered to adopt a student-centred perspective on learning. The findings are reflected through a theoretical framework, which consists of a learning community approach and the Technology Integration Matrix (TIM). This study contributes to the pedagogical development of the teacher education practicum and provides a perspective on aspects of how to implement a collaborative approach in the teacher education curriculum, thereby facilitating the implementation and development of new practices in teacher education practicums.

Keywords: meaningful digital pedagogy, teacher education practicum, Technology Integration Matrix, phenomenography, learning community

Introduction

There has been great interest in and a need to integrate digital technology in Finnish primary school education, and, consequently, in teacher education over the last decade (Kimav and Aydin, 2020; Lähdesmäki and Valli, 2018). Although technological competence is essential in the digitised world, both in working life and generally to function as an active citizen of society, technology integration in teacher education seems problematic, rendering it questionable whether student teachers are adequately prepared for their future working lives (Li, 2021; Ngao, Sang and Kihwele, 2022). Ample research about student teachers' perspectives concerning teacher education practicums has been conducted (Çapan and Bedir, 2019; Mukeredzi and Manwa, 2019; Wang and Apraiz, 2018). A study by Ngao, Sang and Kihwele (2022) found that student teachers were willing to use digital technologies in their teaching. However, simultaneously, some university teacher educators lacked an understanding of the rationale behind the use of technology and questioned its application in their teaching methods. Furthermore, the study revealed that equipment limitations, heavy teaching workloads and time constraints were significant barriers to incorporating technology into teaching and learning activities. University teacher educators employed various software and online platforms, including social media and journal subscriptions, to access learning materials. However, the pedagogical use of technology was missing (Ngao, Sang, and Kihwele, 2022). This scarcity corroborates the findings of Amhag, Hellström and Stigmar (2019), which revealed that teacher educators did use digital technology, but not primarily for pedagogical purposes. The poor integration of technology for pedagogical purposes in teacher education and the need for new ways to equip student teachers with adequate digital competence for their future were also noted by Amhag, Hellström and Stigmar (2019).

The observation of teacher educators' utilisation of technology in their work could have a substantial impact on the student teachers' professional development and future teaching practices (Ngao, Sang, and Kihwele, 2022). This view is consistent with a study by Tondeur et al. (2019), which also found teacher educators' roles significant in the preparation of student teachers for the educational use of digital technology. However, it is a challenging task for teacher educators to equip student teachers with the necessary competence to effectively integrate technology into their future teaching methods, highlighting the importance of continuously updating one's competence in the pedagogical use of educational technology (Amhag, Hellström and Stigmar, 2019; Tondeur et al., 2019). Notably, mere integration of digital technologies into teaching does not guarantee an improvement in the learning process. There is a potential correlation between students' weaker learning outcomes at the age of 15 and the increased prevalence of self-directed learning practices and frequent utilisation of digital learning materials (Saarinen, 2020). This correlation promotes the need to conceptualise meaningful digital pedagogy.

The practicum periods during student teacher training provide an opportunity to explore and develop prospective teachers' professional identities and competences (Anspal, Leijen and Löfström, 2019; Väättäjä, 2023; Väättäjä and Frangou, 2021). Simultaneously, the collaboration among universities, which are known for their theory and research-oriented environment, and schools, which focus on structured learning, has proven to be advantageous in facilitating opportunities for reciprocal learning

among student teachers, in-service teachers and teacher educators (Heikonen, Toom, Pyhältö, Pietarinen, and Soini, 2017; Kyllönen, 2020; Resch, Schritteser, and Knapp, 2022; Väätäjä, 2023; Väätäjä and Frangou, 2021). Hence, the practicum provides an opening for technology integration in a collaborative way, in which the teacher educators, in-service teachers and student teachers can combine all parties' strengths, linking theoretical backgrounds with technological choices during the practicum while learning with and from each other (Väätäjä, 2023; Väätäjä and Frangou, 2021). The teacher education practicum, therefore, also provides opportunities for in-service teachers to learn from student teachers, and can therefore be considered a learning environment for in-service teachers and teacher educators (Kyllönen, 2020; Helin, 2014).

The research contributes to the field of teacher education by responding to the need for more research on technology integration in teacher education and the collaborative development of the practicum periods of teacher training. Hence, the findings provide important perspectives for teachers, teacher educators and teacher education curriculum developers that embrace equality and engagement throughout the collaborative practicum process related to meaningful digital pedagogy. This study contributes to the pedagogical development of the teacher education practicum and provides perspectives on how to implement a learning community approach in the teacher education curriculum and, thereby, the practicum, hopefully leading to the implementation of new practices.

Theoretical Framework

This study employed the concepts of learning communities and the Technology Integration Matrix (TIM) (Harmes, Welsh, and Winkelman, 2016) to reflect on and theorise about the practices for collaborative and meaningful use of digital technologies as part of the teaching process. The TIM was used in this research because it provides both characteristics of meaningful learning environments and levels of technology integration. The background of the study arises from the need to identify ways to develop technology-enhanced pedagogy that encourages student teachers, their supervising in-service teachers and university teacher educators to engage in lifelong collaborative learning. Generally, the learning community implementations share the common feature that they are employed as an approach in different settings to achieve social interaction and collaboration for improving teaching and student learning (Akiba and Liang, 2016; Doğan and Adams, 2018; Stoll et al., 2006; Vescio et al., 2008). In this study, the learning community refers to a group of individuals with the common goal of enhancing their knowledge, skills and understanding in a particular subject or field.

Learning communities can take various forms, from traditional classroom settings to online platforms and informal gatherings. Their primary aim is to create an environment in which participants can engage in collaborative learning, share ideas, exchange experiences and support each other's learning journey (Næsheim-Bjørkvik, Helgevold and Østrem, 2019; Polly, Heafner, Chapman, Spooner, 2014; Pont, Nusche, Moorman and Hopkins, 2008; Robinson, Lloyd and Rowe, 2008). The teacher education practicum provides the context for the learning community, which involves student teachers, teacher educators from universities and in-service teachers from university training schools. Furthermore, considering the cultural context is crucial when embracing a learning community approach. Culture

plays a significant role in shaping people's beliefs, values, communication styles and learning preferences. Adapting a learning community approach to the cultural context ensures that the community is inclusive, effective and respectful of diverse perspectives (Pan and Cheng, 2023). The active and collaborative learning perspectives are also recognisable within the TIM framework. The TIM theorises the meaningfulness and depth of technology integration and provides five interconnected and broad characteristics for meaningful learning environments. The matrix was created by the Florida Center for Instructional Technology and is an educational framework used to assess the integration of technology in teaching and learning processes. The TIM helps educators, administrators and policymakers understand how technology is being utilised in the classroom and how it can enhance different aspects of instruction (Harmes, Welsh and Winkelman, 2016).

First, the TIM represents the characteristics of learning environments, focusing on the classroom environment, and describes how technology is utilised within different instructional settings. The TIM comprises five characteristics of meaningful learning: active, constructive, authentic, collaborative and goal-directed. *Active* use of technology by students involves using it as a tool rather than passively receiving information from it. When students demonstrate *constructive* use of technology, they employ technology to connect newly acquired information with their existing knowledge. *Authentic* usage of technology means students apply technological tools to relate their learning activities to real-life situations. The *collaborative* aspect entails students using technological tools to collaborate rather than work in isolation. Being *goal-directed* with technology involves using it to set objectives, plan activities and reflect on the entire learning process (Harmes, Welsh and Winkelman, 2016).

Second, in the TIM framework, the levels of technology integration represent a continued use of technology in the learning process, from minimal integration to seamless integration. The five levels are presented as follows: 1) entry level, 2) adoption level, 3) adaptation level, 4) infusion level and 5) transformation level. The *entry level* is the point at which technology is occasionally utilised and often lacks a distinct connection to the curriculum. Technology might be used as a supplementary tool or a reward. At the *adoption level*, technology is employed as a direct tool to support specific learning objectives. Technology is often seen as a substitute for traditional instructional methods. The *adaptation level* is the point where technology use becomes more frequent and educators begin to modify instructional strategies to better align with technology tools. Technology becomes an integral part of the learning process at this level. At the *infusion level*, technology is infused throughout the curriculum and its use is seamless with learning activities. Technology enhances and transforms the learning experience at this level. At the *transformation level*, technology is utilised to encourage pupils to make innovative use of technologies to facilitate higher-order learning activities, which may not be possible without the use of technology (Harmes, Welsh and Winkelman, 2016). Säljö (2010) agrees somewhat with the profound idea of TIM by stating that technologies not only aid learning but also actually change the way we learn and understand the learning process.

In conclusion, the TIM and the learning community approach combine collaborative practices, meaningful learning and technology integration levels, offering descriptions of their characteristics and thus providing a fitting theoretical background for this study.

Research questions

It is against this background that we seek to identify features related to collaborative and meaningful digital pedagogy during the teacher education practicum. Hence, our objective is to develop the practices and pedagogy of the teacher education practicum that support collaborative planning of digital technology integration in teaching by student teachers, their supervising in-service teachers and university teacher educators. Therefore, the teacher education practicum provided a fitting context for conducting this research involving collaborating and reflecting in authentic real-life settings, establishing a place for collaborative learning.

In this study, we examine the experiences of university teacher educators, student teachers and in-service teachers and ask the following research questions:

1. *What meanings do participants attribute to the collaborative practices in the teacher education practicum?*
2. *What are the participants' conceptions of meaningful digital pedagogy in the context of the teacher education practicum?*

Methodology

Phenomenographic research

The study is conducted following a phenomenographic research approach, which is grounded on the premise that there are a limited number of logically related ways to experience, understand or conceptualise a particular phenomenon (Marton, 1981; Marton and Booth, 1997; Marton and Pong, 2005). In this study, however, the term 'conceptualise' is used instead of 'experiencing' or 'understanding' because the focus lies on conceptual features rather than sense-related features. In this study, 'conception' is the unit of description (Marton and Pong, 2005). Conceptualising collaborative practices and meaningful digital pedagogy within the context of teacher education practicum is a multifaceted social phenomenon defined by diverse domains of expertise, all within the backdrop of swiftly evolving digital and educational landscapes. For these reasons, phenomenography serves as a fitting research approach (Marton and Pong, 2005; Sin, 2010).

Participants and context

This study involves participants from school and university organisations. The participants of this study were student teachers (N=8), supervising in-service teachers (N=4) and university teacher educators (N=4) involved in guided advanced practicum, which is a part of the Primary School Teacher Education Curriculum of the University of Lapland. The guided advanced practicum is completed at the University of Lapland's teacher training school, and it is worth seven European Credit Transfer and Accumulation System (ECTS) credits. Student teachers complete five practicum periods during their five-year study, one practicum per year. The student teachers participating in this study had just finished their fourth year's practicum period, and the interviews were conducted in the small groups in which the student teachers had worked throughout the practicum for mentoring and support. The interviews were organised in conjunction with the groups' final reflective meeting. The fourth practicum period provided

a suitable context for this research because the student teachers have accumulated enough experience to discuss aspects related to not only teacher education practicum but also pedagogical issues.

In Finland, teacher training schools are administratively part of the faculties of education and have several duties. These duties encompass providing education for both comprehensive and upper secondary levels, mentoring and supervising student teachers, nurturing their pedagogical skills and preparing them for the demands of the profession. Teacher training schools also delve into teaching experiments and research, contributing to the development of innovative teaching methodologies. The duty of teacher training schools is to offer in-service education to educators, ensuring that teaching staff remain updated and equipped with the latest knowledge and techniques in the ever-evolving field of education (FTTS, 2023). In-service teachers involved in the study are working in the field of education, specifically in the University of Lapland's Teacher Training School. Each teacher was responsible for supervising two student teachers during their practicum period and providing important experiential knowledge and perspectives on how to meet the real-world challenges of working life. University teacher educators are faculty members who are responsible for training and supervising student teacher during practicum periods but also throughout their studies. Their insights are important for understanding the academic and theoretical aspects of teacher preparation and pedagogy.

Data collection

In this study, we use group interviews as a data collection method, in which participants collectively discuss collaborative practices and meaningful digital pedagogy in the context of teacher practicum. In total, there were four individual group interviews. Each of the groups consisted of two student teachers, one university teacher educator and one supervising in-service teacher. Each of the groups was interviewed once. In this study, a semi-structured interview design (Wilson, 2016) was employed to enhance the conversational quality of data collection. This approach allowed for slight adjustments to interview questions and asking follow-up questions, thereby reducing the risk of omitting valuable information from the study (Wilson, 2016). The interviews maintained the same structure for all four group interviews. Semi-structured questions provided consistency for researchers to compare the insights and perspectives of these different groups. At the University of Lapland, the student teachers work in pairs during the practicum and are assigned one university teacher educator and one in-service teacher from the school to supervise and support them during the practicum period.

The interviews consisted of two parts. The questions in the first part of the interview were related to the collaborative practices among the university teacher educators, in-service teachers and student teachers in the context of teacher education practicum. The questions in the first part were formulated as follows:

1. What kinds of collaborative practices do you implement in teacher education practicums?
2. How did these collaborative practices support the development of your competence?
3. What is the meaning of these collaborative practices?

4. What other means can you propose for collaboration and enabling learning experiences for all of you?
5. How do you view the teacher education practicum?

The second part included questions about meaningful digital pedagogy. The questions related to this part were formulated in such a manner that participants could discuss what makes the use of digital technologies meaningful in educational settings. The questions for the second part were formulated as follows:

6. What does digital pedagogy mean to you?
7. What makes digital pedagogy meaningful?
8. What factors make the use of technology in teaching meaningful?
9. How has your digital pedagogical competence developed during the practicum period?
10. How could the teacher education practicum serve as a context for co-developing digital pedagogy?

Phenomenographic research typically involves collecting data through interviews, observations or written accounts (Marton and Pong, 2005). The researcher seeks to elicit participants' experiences, perceptions and understandings related to the phenomenon of interest. Open-ended questions and prompts are often used to encourage participants to reflect on their experiences in depth and provide rich descriptions. The interview questions were selected to create a conversational atmosphere in which participants could freely share their ideas and approach the topic at hand. Each of the interviews lasted 30–40 minutes. Table 1 represents the lengths of the individual group interview transcriptions.

Table 1: Length of the individual group interview transcriptions

Group participants	Length of the material
Group 1 <ul style="list-style-type: none"> ● student teacher 1 ● student teacher 2 ● in-service teacher 1 ● university teacher educator 1 	5020 words
Group 2 <ul style="list-style-type: none"> ● student teacher 3 ● student teacher 4 ● in-service teacher 2 ● university teacher educator 2 	5177 words
Group 3 <ul style="list-style-type: none"> ● student teacher 5 ● student teacher 6 ● in-service teacher 3 ● university teacher educator 3 	3546 words

Group 4 <ul style="list-style-type: none"> ● student teacher 7 ● student teacher 8 ● in-service teacher 4 ● university teacher educator 4 	4167 words
Total	17910 words

The group interviews were audio recorded by phone and later transcribed verbatim. Recorded audio files were stored on a personal OneDrive for Business folder, which is provided by the University of Lapland to its personnel. The stored data were encrypted to guarantee the anonymity of the participants.

Data analysis

The data analysis is conducted following a qualitative phenomenographic analysis process, which involves categorising the conceptions and uncovering the underlying structures that give rise to those experiences (Svensson, 1997). Rather than aiming to generalise findings or establish cause-and-effect relationships, phenomenography seeks to uncover the qualitatively distinct ways in which individuals conceptualise a phenomenon. These ways, known as conceptions, form a hierarchical relationship where more complex conceptions build upon simpler conceptions. The goal of phenomenography is to identify and describe these conceptions, providing insights into the range of possible conceptions within a particular context (Marton and Pong, 2005; Svensson, 1997). The study employs an inductive approach, commencing with a collection of observations and subsequently progressing from these specific experiences to a more general set of propositions about those conceptions.

The researcher engages in a systematic process of categorisation, grouping participants' responses based on similarities and differences in their conceptions (Marton and Pong, 2005; Svensson 1997). This process involves examining the underlying structures and relationships between the categories, with the aim of developing a comprehensive conceptualisation of the variation in experiences. Next, to determine the variation in the conceptions of student teachers, supervising in-service teachers and university teacher educators about meaningful digital pedagogy and collaboration with each other in the context of teacher education practicum, the data were interpreted and coded into units of description. Categories of description were identified by sorting and re-sorting the individual units. The aim was to transcend various ways of conceptualising the phenomenon into more overarching themes to illustrate how awareness expands along the given theme when transitioning from less comprehensive ways to more comprehensive ways of encountering the phenomenon (Åkerlind, 2018). The NVivo qualitative data analysis software was selected to assist in the coding and categorisation processes.

One of the key outcomes of phenomenographic research is the development of an outcome space, which represents the hierarchical relationships among the identified conceptions. The outcome space provides a visual representation of the different ways in which individuals conceptualise the phenomenon, with the more complex conceptions located at higher levels of the hierarchy. This outcome space serves as a theoretical framework for understanding the phenomenon and can be used to inform future research and educational practice (Åkerlind, 2005). This chapter has provided an

overview of the phenomenographic research methodology employed in this study, its key principles and its application in exploring the different ways in which individuals conceptualise collaborative practices and meaningful digital pedagogy in the context of teaching practicum. The following will delve into the findings and implications derived from this phenomenographic analysis, contributing to a deeper understanding of the phenomenon and its implications for practice.

Results

The results indicate that collaborative practices offer opportunities for the development of meaningful digital pedagogy in the context of teacher education practicum. Figure 1 summarises the results provided by the phenomenographic analysis.

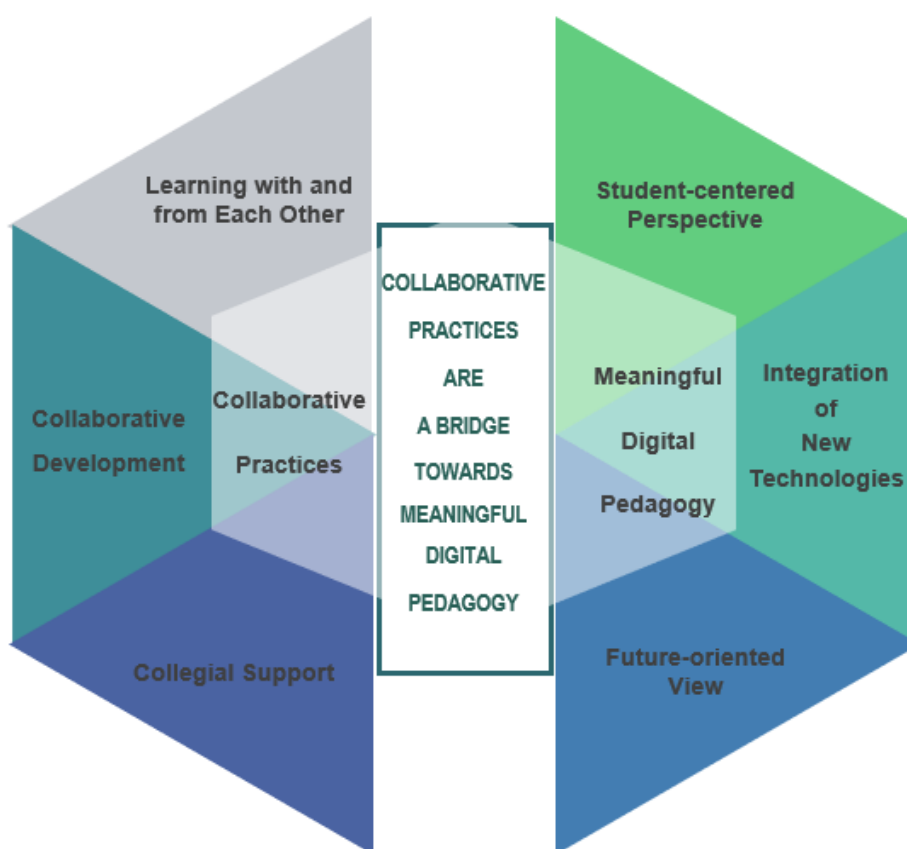


Figure 1. Findings from research questions 1 and 2.

The categories formed by the phenomenographic analysis and the answers to the research questions are presented in this section. The first research question is presented as follows: “*what meanings do participants attribute to the collaborative practices in the teacher education practicum?*” To answer this question, the relevant items regarding the research topic were identified and consequently clustered in categories (Table 2). These categories are combined with the findings of research question 2 in Figure 1.

Table 2: Outcome space of collaborative practices among university teacher educators, in-service teachers and student teachers in the context of teacher education practicum

Units of description	Description of category	Number of references in the data
<ul style="list-style-type: none"> • <i>Reflective conversations</i> • <i>Strategies to support well-being and improve job satisfaction</i> • <i>Collaborative reflection</i> • <i>Increased confidence</i> • <i>Efficient lesson planning</i> 	<i>Context for learning with and from each other</i>	16
<ul style="list-style-type: none"> • <i>Importance of thoughtful implementation</i> • <i>Research-based decision-making</i> • <i>Supportive environment in which educators can experiment with different methods</i> 	<i>Context for collaborative development</i>	11
<ul style="list-style-type: none"> • <i>Equality</i> • <i>Respect and appreciation of each other's expertise</i> • <i>Broader educational dialogue, such as discourse on teachers' professional identity development</i> 	<i>Context for collegial support</i>	8

Learning with and from each other

The category includes the idea of engaging in reflective conversations with student teachers and discussing their strengths, areas for development and significant learning experiences during practicum periods.

I feel that practicum is a platform where student teachers, when they come to school, learn a lot from their more experienced colleagues. But the experienced colleagues also learn from the student teachers. (In-service teacher 4)

Additionally, the in-service teachers mention their own involvement in various educational projects and collaborations with colleagues, which allows them to bring their own interests and strengths into the teaching practice and contribute to the growth of the students and the overall team (cf. Harmes, Welsh and Winkelmann, 2016; Næsheim-Bjørkvik, Helgevold and Østrem, 2019). The conversation touches on the significance of teachers' well-being and work-life balance.

Coping on the job is incredibly important because it is also related to staying in the field that is, what is our teachers' well-being at work, what things affect it, what burdens it and how could it be made easier? (In-service teacher 3)

The participants highlight the importance of addressing factors that affect teachers' well-being and suggest strategies to alleviate workload and improve job satisfaction.

Context for collaborative development

The context for collaborative development includes the idea of engaging in discussions about various aspects of teaching, including assessments, well-being, cooperation with parents and the broader responsibilities of being an educator. The value of reflecting on teaching practices and exploring ways to continue improving and developing as professionals is emphasized.

In general, about the day, what has happened, the kind of situations there have been with the pupils, and then, in general, all things related to the teacher's work, like evaluations, coping at work and cooperation with the pupils' parents, and really extensively, everything about this job, is related. (Student teacher 1)

The participants who share this view understand practicum as a context to collaborate and develop pre-existing teaching practices. They highlight the importance of having space and time for experimenting and learning from them.

Context for collegial support

The context for collegial support encompasses the idea of a significant difference when all of the participants of the practicum feel welcome and emphasises the importance of a respectful atmosphere and appreciation of each other as teaching professionals.

Yes, I think we have quite different points of view, but we are all on an equal footing here, discussing our areas of expertise and learning from each other. (University teacher educator 2)

The participants who share this view understand practicum periods as platforms for collegial support, where members from different backgrounds are accepted for who they are. During the practicum periods, the participants discuss the challenges faced by teachers in participating in public discussions and influencing educational policies. They mention the possible limitations of teachers in speaking openly due to potential repercussions, despite their desire to contribute their insights and experiences to the broader education dialogue (cf. Pan and Cheng, 2023).

Regarding technology integration into teaching and learning during the practicum, the second research question is presented as follows: "*What are the participants' conceptions of meaningful digital pedagogy in the context of teacher education practicum?*" The participants' conceptions regarding this topic have been categorised and quantified in Table 3 and combined with the findings of research question 1 in Figure 1.

Table 3: Outcome space of meaningful digital pedagogy

Units of description	Description of categories	Number of references in the data
<ul style="list-style-type: none"> ● <i>Personalised learning experiences</i> ● <i>Engagement and collaborative learning with technology</i> ● <i>Instructional support with technology</i> ● <i>Redefined roles of teachers and students</i> 	<i>Student-centred perspective</i>	16
<ul style="list-style-type: none"> ● <i>Necessary digital skills for the future</i> ● <i>Employability</i> 	<i>Future-oriented view</i>	12

<ul style="list-style-type: none"> • <i>Enhancement of traditional pedagogical approaches</i> • <i>Utilising digital tools for interaction</i> • <i>Creating a bridge between school and home</i> 	<i>Integration of new technologies</i>	8
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Student-centred perspective

The first category, the *student-centred perspective*, encompasses the idea that meaningful digital pedagogy should adopt a student-centred approach, considering the students' preferences and prior knowledge when selecting digital tools and platforms.

They (digital tools) can be used to increase pupils' well-being. For example, if a pupil comes up to me and says that reading is difficult for them, I can suggest listening to the ebook. There is no better way to create value than by using them. (University teacher educator 2)

Using familiar platforms allows the teacher to focus on the lesson's content while avoiding spending too much time teaching pupils about the tool's functionalities. (Student teacher 3)

The participants who share a *student-centred perspective* understand meaningful digital pedagogy as a means to make learning engaging and accessible by using digital tools. The participants also highlight that the use of digital tools with which pupils are already familiar reduces the need for extensive teaching of new technologies during the lessons. According to the participants, there is also a significant shift in teaching practices in classrooms that embrace digital tools compared to those that do not (cf. Harnes, Welsh and Winkelman, 2016; Säljö, 2010). The participants who share this view emphasise how digital pedagogy fosters collaborative learning, creative expression and more personalised learning experiences, enhancing both student and teacher engagement.

For pupils to achieve the learning objectives, it is important that we provide them with versatile tools that will allow them to be creative and collaborate. (In-service teacher 1)

I want to be more than a talking head behind the screen, which is why I am interested in the possibilities of digital tools regarding collaborative learning. (University teacher educator 1)

The participants who share this view believe that the value of digital pedagogy lies in the innovative teaching practices it enables rather than the technology itself.

Future-oriented view

The second category, the *future-oriented view*, encompasses the general idea that meaningful digital pedagogy is understood as a means to prepare students for the future by equipping them with essential digital skills. The participants emphasise the importance of introducing students to various digital tools and platforms, which are commonly employed in the current workforce, to enhance their employability and adaptability in the ever-changing technological landscape.

I feel that we need to ensure that pupils become familiar with different kinds of digital platforms already in schools to provide them with a good foundation for working life and those future skills. (In-service teacher 1)

The participants who share this view emphasise the societal significance of incorporating digital pedagogy to address rapid global changes and ensure that students are equipped with relevant skills and knowledge. The participants who share this *future-oriented view* avoid creating dichotomies between “normal” or “traditional” pedagogy and digital pedagogy. They aim to seamlessly blend both approaches and avoid presenting them as conflicting or mutually exclusive options (Redecker and Punie, 2017).

Technological integration

The third category, *technological integration*, encompasses the idea that digital pedagogy is an integral part of modern teaching practices, considering it as a tool that enhances traditional pedagogical approaches rather than a separate teaching method. The participants aim to seamlessly integrate technology into their teaching, maintaining a balance between traditional and digital teaching methodologies.

The use of digital tools should not be understood as a requirement in every lesson but should be utilised to the extent that they support learning. (In-service teacher 3)

The teaching should be goal-oriented, so if some digital tools can help me go towards that goal, then it is indeed in the right place at the right time. (Student teacher 2)

The participants who share this view did not consider that the use of digital tools would necessarily affect a change in teaching practices. The participants mentioned that various digital tools and platforms can be used, for example, to create engaging language learning activities, such as word games and reading exercises (cf. Harmes, Welsh and Winkelman, 2016). Such activities can also be implemented without using digital tools. The findings provide evidence that digital tools can be used as part of pre-existing teaching practices. This view also emphasises that digital pedagogy can help create a bridge between school and home.

We have tried to more efficiently use digital tools such as Wilma to inform guardians about what has been accomplished here and what has been carried forward in digital pedagogy so that they can understand that, for example, mobile phones can be used for reasonable learning activities. (In-service teacher 1)

This view also emphasises that, by leveraging technology, it is possible to create and implement interactive environments to reduce the time spent on mundane administrative tasks and allow for more meaningful interactions with pupils and their guardians.

These distinct ways of understanding digital pedagogy showcase the diversity of perspectives and the varied implications of digital pedagogy on teaching practices, student learning experiences and overall educational goals. Educators' backgrounds, experiences and teaching contexts play a significant role in shaping their interpretations and applications of digital pedagogy.

Discussion, limitations and conclusions

The conceptions of student teachers, supervising in-service teachers and university teacher educators regarding the teacher education practicum reveal the significance of the collaborative work during the

practicum for all involved, which is consistent with the concept of a learning community (cf. Næsheim-Bjørkvik, Helgevold and Østrem, 2019). The findings are also consistent with the TIM framework's five characteristics of meaningful learning: *active, constructive, authentic, collaborative and goal-directed* (Harmes, Welsh and Winkelman, 2016). However, in this context, the involvement of technology is more vaguely discussed. The participants appreciated that the teacher education practicum provided a context for the participating members to *actively* learn with and from each other (Heikonen, Toom, Pyhältö, Pietarinen, and Soini, 2017; Kyllönen, 2020; Resch, Schritteser, and Knapp, 2022; Väättäjä, 2023; Väättäjä and Frangou, 2021). The things everybody can learn are related to efficient and *constructive* lesson planning, developing strategies to support well-being and improving job satisfaction. The second most shared idea was that the teacher education practicum is a *goal-directed* context for *collaborative* development. The goal is to develop one's digital pedagogical skills, pedagogical competence and teacher's professional identity. *Collaboration* is related to research-based experimentation and collaborative supervision, which can result in changes in *authentic* classroom practices and experimentation with new methods and technologies (cf. Akiba and Liang, 2016; Doğan and Adams, 2018). The third and least shared conception was that the teacher education practicum is a context for collegial support, in which all of the participating members should be considered equals, which makes it possible for them to discuss, for example, matters related to their profession in the future and the *constructive* development of working conditions. Having this kind of discussion enables them to understand and participate in the broader national discussion about the future of the teaching profession.

Digital pedagogy is subject to varying interpretations among educators. For certain individuals, digital pedagogy entails the refinement of pre-existing instructional approaches. Conversely, others perceive digital pedagogy as a means to facilitate a more holistic advancement of the learning process, entailing a re-evaluation of the roles assumed by both educators and learners (cf. Säljö, 2010). Furthermore, there exists a viewpoint positing that digital pedagogy holds a broader significance, particularly concerning the preparation of young individuals for the future. This significance pertains to their imperative need to acquire proficiency in navigating novel technological tools, even those that are not inherently pedagogical in nature. The conceptions of student teachers, supervising in-service teachers and university teacher educators regarding meaningful digital pedagogy reveal the diversity of digital competence that will be required of future teachers. Teachers are teaching the workforce of tomorrow's society, which necessitates future-oriented and student-centred approaches in the classroom. It seems that teachers need to have the competence to switch between all the levels of the TIM framework—*entry level, adoption level, adaptation level, infusion level and transformation level* (Harmes, Welsh and Winkelman, 2016)—in order to provide meaningful, active, participatory and motivating learning experiences to the learners involved in the practicum. Most of the participants conceptualise meaningful digital pedagogy as a student-centred perspective on teaching that enables them to create personalised learning experiences, embrace engagement with technology and enhance instructional support with technology. The second most common conception was that meaningful digital pedagogy is about having a future-oriented view that is not only related to enhancing teaching practices but also provides pupils with the necessary basics for them to be able to navigate the digitalised world of the future. The

participants shared the view that they have to provide pupils with skills that will help them learn future technologies.

The particular strength of this study is its methodology, as phenomenography allows for an in-depth exploration of individuals' conceptions, capturing the richness and complexity of their understandings. This study provides a holistic view of the collaborative practices and meaningful digital pedagogy in the context of teacher education practicum, incorporating multiple perspectives and allowing for the identification of patterns and relationships. Furthermore, phenomenography can contribute to the development of educational practices and interventions by highlighting the different ways in which learners understand and engage with a subject. Although the findings of this study contribute to a good understanding of the conceptualisation of collaborative practices and meaningful digital pedagogy in the context of a teaching practicum, it has some limitations. First, the phenomenographic approach requires active engagement and interaction between the interviewer and the interviewees. Thus, it is important to acknowledge that this interaction can sometimes be perceived as a methodological weakness, as it introduces an element of potential interviewer influence. Sin (2010) introduced the following practical considerations for the interviews to minimise interviewer influence, which were followed by the first author. In the interviews, a deliberate effort was made to ensure clear communication. These efforts involved avoiding assumptions about the meanings of interviewees' expressions, opting instead to use follow-up questions for clarification. The researcher refrained from introducing new terms or correcting interviewees and allowed time and space for thoughtful responses while maintaining a neutral facial expression to avoid influencing any interviewees' answers (Sin, 2010.) Second, the interpretation of conceptions and the construction of an outcome space involve subjective judgments by the researcher, which can introduce bias. Therefore, the authors have investigated the data both individually and collaboratively to reduce the potential for individual author's subjective judgements.

In conclusion, teacher education programmes should prioritise providing comprehensive training in digital skills and technology integration to ensure future teachers' ability to change their technology integration level according to the situation at hand and to create the best possible meaningful learning environment for learners, as described by the TIM framework (Harmes, Welsh and Winkelman, 2016). In-service teachers and university teacher educators also need to keep pace with technological developments. This professional development could include workshops, courses and hands-on practice sessions that would be beneficial for ensuring that experienced and inexperienced educators become proficient in using digital technologies for teaching and learning (cf. Ngao, Sang and Kihwele, 2022). The authors state that teacher education practicums provide excellent communities where teacher educators, in-service teachers and student teachers can collaborate, share resources and exchange ideas related to technology integration, which can help them collectively overcome challenges. Thus, it would be beneficial for teacher education curriculum development to consider the possible avenues for university teacher educators and in-service teachers to learn and be active actors in the learning community, beyond the learning objectives established for the student teacher. Teacher education practicums have the potential of being more than merely a study course for student teachers.

This research contributes to knowledge by highlighting the important role that collaboration during the teaching practicum plays in teacher education. This paper reveals the importance of teamwork and reciprocal learning and the significance of meaningful digital pedagogy. Hence, the findings add to the literature on teacher training and provide important perspectives for teachers, teacher educators and teacher education curriculum developers that embrace equality and engagement throughout the collaborative practicum process, which will hopefully leads to the implementation of new practices.

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